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(54) **HEAT DISSIPATING CASE**

(56) **References Cited**

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G06F 1/206; G06F 2200/203; G06F 1/20  
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312/223.2

See application file for complete search history.

**U.S. PATENT DOCUMENTS**

6,288,896	B1	9/2001	Hsu	
6,437,978	B1 *	8/2002	Ozaki et al.	361/679.46
6,816,371	B2 *	11/2004	Agata et al.	361/679.27
7,254,019	B2	8/2007	Leu et al.	
7,746,631	B2	6/2010	Ali	
2005/0111183	A1 *	5/2005	Pokharna et al.	361/687
2008/0130221	A1	6/2008	Varadarajan et al.	
2009/0154084	A1	6/2009	Goto et al.	
2009/0207569	A1	8/2009	Tsunoda et al.	
2012/0155020	A1 *	6/2012	Nishi	361/679.55

(Continued)

**FOREIGN PATENT DOCUMENTS**

CN	1508649 A	6/2004
KR	20-0225459	6/2001

(Continued)

**OTHER PUBLICATIONS**

International Search Report and Written Opinion received in PCT  
Application No. PCT/US2011/046017, mailed on Feb. 28, 2012, 9  
pgs.

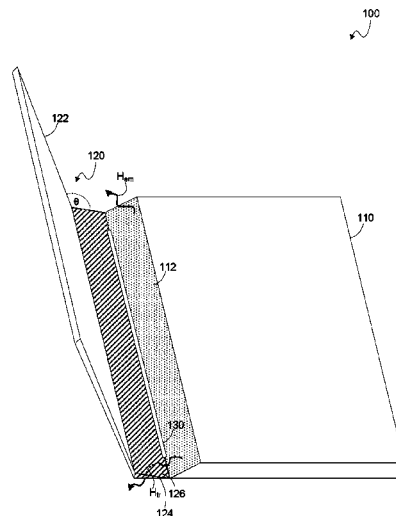
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(57) **ABSTRACT**

Example embodiments disclosed herein relate to a case hav-  
ing a base unit and a display unit. The base unit includes an  
emitting surface. The display unit includes a dissipating  
member. A hinge connects the base unit and the display unit,  
the hinge connected below at least part of the heat emitting  
surface or first vent and the heat dissipating member or sec-  
ond vent. The emitting surface and the dissipating member  
are to overlap or align when the display unit is in a closed  
position.

**15 Claims, 5 Drawing Sheets**



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(56)

## References Cited

## FOREIGN PATENT DOCUMENTS

### U.S. PATENT DOCUMENTS

2013/0163201	A1*	6/2013	Wang et al. ....	361/692
2014/0029187	A1*	1/2014	Okuley et al. ....	361/679.09
2014/0098489	A1*	4/2014	Chiriac et al. ....	361/679.54

KR	10-0513010	9/2005
TW	200850104 A	12/2008
TW	201024981 A	7/2010

\* cited by examiner

FIG. 1

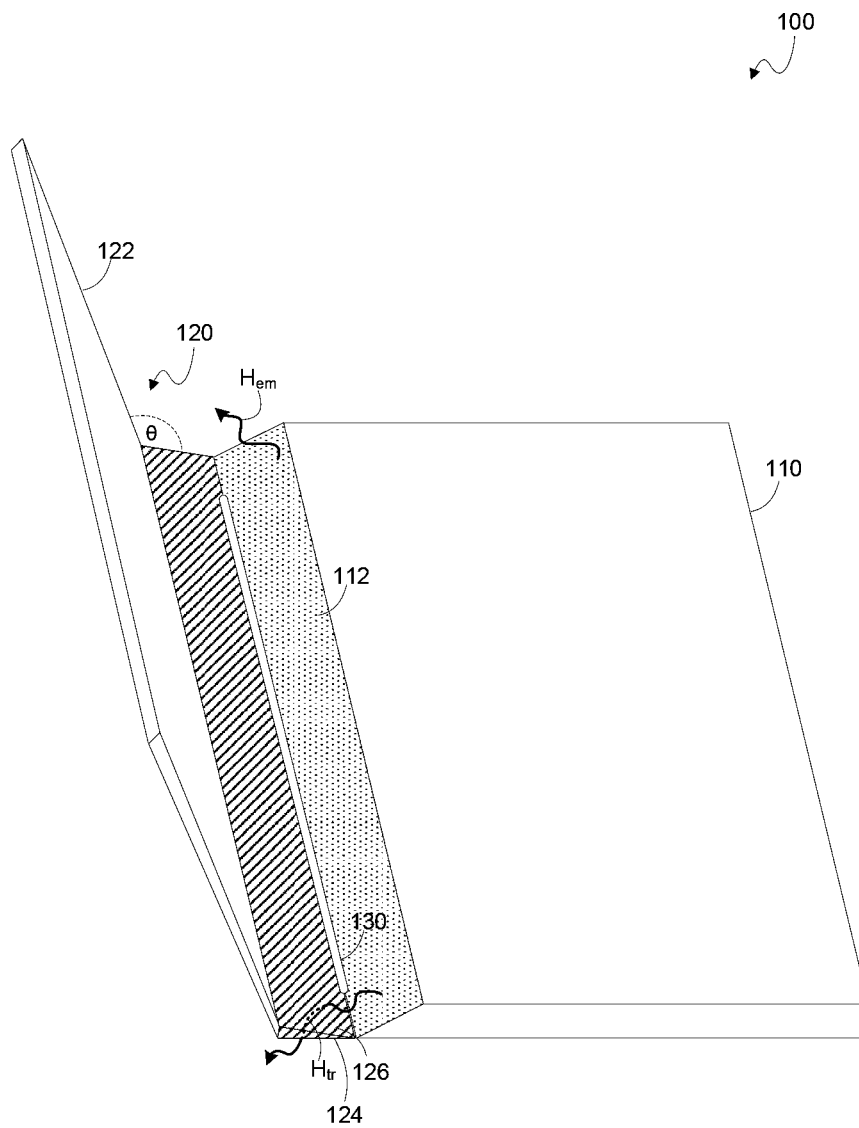


FIG. 2

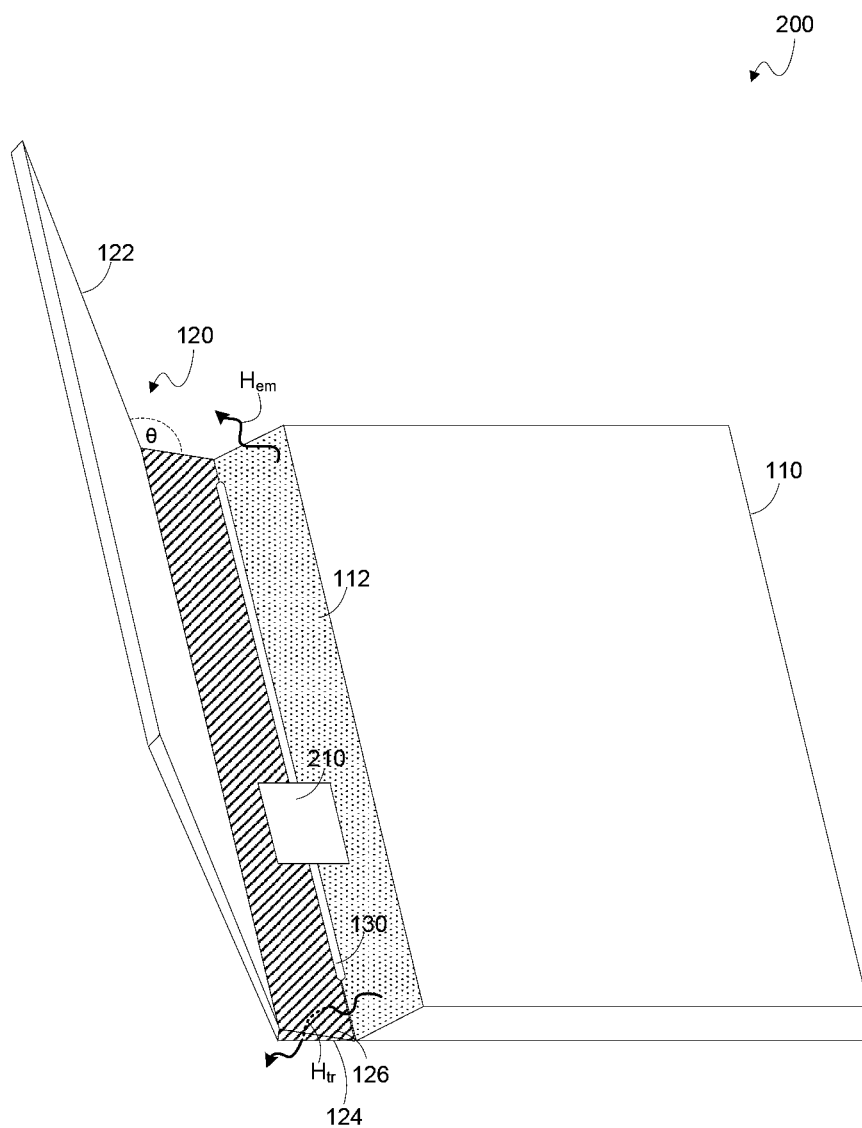


FIG. 3A

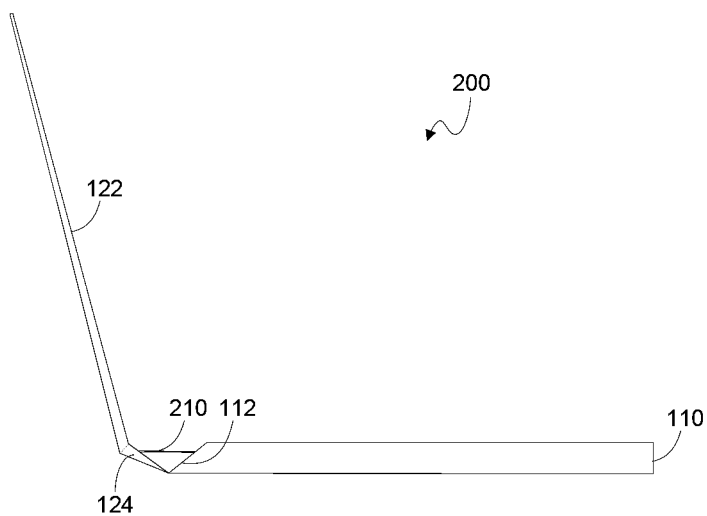


FIG. 3B

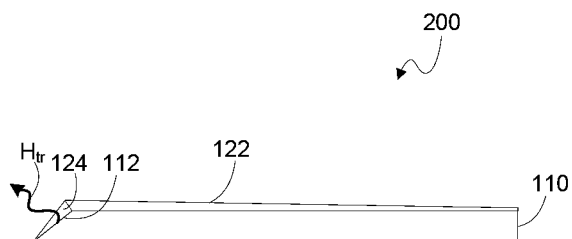


FIG. 4A

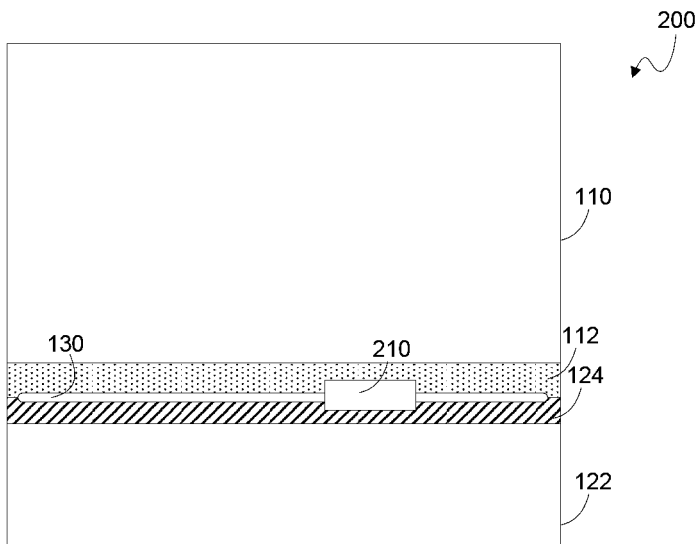
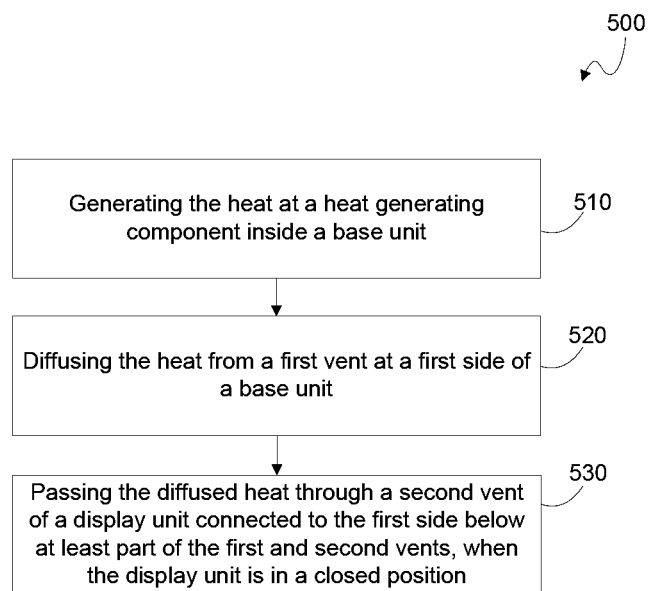


FIG. 4B



FIG. 5



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## HEAT DISSIPATING CASE

### BACKGROUND

Case designs of devices are increasingly changing to accommodate for user preferences. For example, some cases have adopted a dropped hinge to lower a height of a display of the device. Device manufacturers are challenged to provide new case designs that enhance or do not limit a functionality of the device.

### BRIEF DESCRIPTION OF THE DRAWINGS

The following detailed description references the drawings, wherein:

FIG. 1 is an example diagram of a perspective view of a case;

FIG. 2 is an another example diagram of a perspective view of a case;

FIG. 3A is an example diagram of a side-view of the case of FIG. 2 with respect to an open position;

FIG. 3B is an example diagram of a side-view of the case of FIG. 2 with respect to a closed position;

FIG. 4A is an example diagram of a top-down view of the case of FIG. 2 with respect to the open position;

FIG. 4B is an example diagram of a top-down view of the case of FIG. 2 with respect to the closed position; and

FIG. 5 is an example flow chart for a method of dissipating heat.

### DETAILED DESCRIPTION

Specific details are given in the following description to provide a thorough understanding of embodiments. However, it will be understood by one of ordinary skill in the art that embodiments may be practiced without these specific details. For example, systems may be shown in diagrams in order not to obscure embodiments in unnecessary detail. In other instances, well-known processes, structures and techniques may be shown without unnecessary detail in order to avoid obscuring embodiments.

The terms above and below will be construed relative to a current orientation of a device shown in the drawings. If an orientation of the device is changed, such as if the orientation is upside down, the terms above and below are to remain construed relative to the orientation shown in the drawings.

Some recent devices, such as notebooks, have adopted a dropped hinge, which has an axis located at a lower point than a traditional hinge. The dropped hinge usually connects a lid of the notebook to a base of the notebook. The dropped hinge lowers a height of a display panel of the lid.

However, the dropped hinge may cause a bottom of the lowered lid to overlap at least a portion of a first side of the base to which the hinge connects. As a result, any thermal exhaust ports located at the first side of the base may be at least partially obstructed by the lid.

Embodiments provide a type of dropped hinge that connects the lid to the first side the base but still allows for heat to pass freely from thermal exhaust ports located at the first side of the base and through at least part of the lid, regardless of whether the lid is an open or closed position.

Embodiments may also include for at least one cable between the lid and the base to be placed along a retractable clutch located above the hinge. Thus, the cable may not obstruct the heat from passing through at least part of the lid while also providing a thinner profile and smoother rotation

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for the hinge. In addition, the hinge may have only a single arm resulting in a simpler design.

Looking at the drawings, FIG. 1 is an example diagram of a perspective view of a case 100. The case 100 may include or be part of an electronic device such as, a notebook computer, a desktop computer, an all-in-one system, a slate computing device, a portable reading device, a wireless email device, a mobile phone, a computing system and the like.

In the embodiment of FIG. 1, the case 100 may enclose a notebook computer and includes a base unit 110 and a display unit 120. The base unit 110 includes a heat emitting surface 112 at a first side of the base unit 110 to emit heat, for example, an opening and/or heat conductive surface. The base unit 110 may also enclose a heat generating component (not shown) to generate heat, with the heat emitting surface 112 to emit the heat of the heat generating unit. The heat generating component may include, for example, a processor. A surface of the base unit 110 and/or display unit 120 may be made of any material in the art, such as a type of plastic, metal, or rubber.

The display unit 120 includes a lid 122 and a stand 124. The stand 124 includes a heat dissipating member 126 to dissipate heat, such as the heat emitted by the heat emitting surface 112. The heat dissipating member 126 may be, for example, an opening and/or heat conductive surface. The opening of the heat emitting surface 112 and/or heat dissipating member 126 may, for instance, be an air vent including a regular or irregular pattern of one or more apertures for the heat to pass through, such as a grill or grid of holes. In addition, a thickness of at least part of the stand 124, such as at the heat dissipating member 126, may be substantially less than that of the lid 122.

The lid 122 is connected to the stand 124 and above the stand 124. The lid 122 may enclose a display (not shown). The term display may refer to any type of electronic visual display device. Examples of the display may include an integrated display device, such as a Liquid Crystal Display (LCD) panel, a plasma panel or other type of display panel.

The angle  $\theta$  between the lid 122 and the stand 124 may be variable according to, for example, a manufacturing design or user specification. Further, the angle  $\theta$  between the stand 124 and the lid 122 may be acute or inward with respect to the base unit 110. For instance, the angle  $\theta$  may be between 90 degrees and 180 degrees.

The case 100 also includes a hinge 130 to connect the base unit 110 and the display unit 120 at the first side of the base unit 110. In FIG. 1, the hinge 130 is connected below the heat emitting surface 112 and the heat dissipating member 126. In embodiments, the hinge 130 may be connected below an entirety or part of the heat emitting surface 112 and the heat dissipating member 130. For example, the hinge 130 may be connected below one or more openings of the heat emitting surface 112 and the heat dissipating member 126.

The hinge 130 may also include and/or interface with a friction component (not shown), such as a friction or detent hinge, to maintain a position of the display unit 120. Thus, the display unit 120 may maintain multiples types of open positions situated along different angles of an axis of the hinge 130.

The hinge 130 may be referred to as a dropped hinge, due to its low axis near a bottom surface of the base unit 110. The hinge 120 may rotate the display unit from a lower point and lower the height of the display. While the hinge 130 in FIG. 1 is shown as a single, continuous hinge, embodiments of the hinge 130 may include various types of one or more hinges of various diameters and/or lengths.



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As shown in FIG. 1, the heat emitting surface **112** is exposed when the display unit **120** of the case **100** is an open position. As a result the heat may emit freely out of the heat emitting surface **112**, as shown by emitted heat line  $H_{em}$ . Further, at least some of the emitted heat may also pass through the heat dissipating member **126**, as shown by transmitted heat line  $H_{tr}$ .

FIG. 2 is another example diagram of a perspective view of a case **200**. In this embodiment, the case **200** of FIG. 2 may be similar to the case **100** of FIG. 1, except the case **200** may also include a cable connection **210** between the display unit **120** and the first side of the base unit **110**, where the cable connection **210** is above the hinge **130**. In addition, as shown in FIG. 2, the cable connection **210** may be between the heat emitting surface **112** and the heat dissipating member **126**.

Further, the cable connection **210** may include a retractable member housing cables, such as power and data cables, which connect between the base unit **110** and the display unit **120**. The retractable member is to move into the base unit **110** when the display unit **120** is rotated towards the base unit **110** and to move out of the base unit **110** when the display unit **120** is rotated away from the base unit **110**. While the cable connection **210** is shown to be closer to a left side of the base unit **110** in FIG. 2, embodiments are not limited thereto. For example, the cable connection **210** may be placed at any point between the heat emitting surface **112** and the heat dissipating member **126** and/or over the hinge **130**.

In addition, the case **200** of FIG. 2 may have the friction component (not shown), such as a clutch, interface with the retractable member, instead of the hinge **130**. For example, the friction component may be located inside the base unit **110** and inhibit a movement of the retractable member, to maintain a position of the display unit **120**. Thus, the display unit **120** may similarly maintain multiples types of open positions situated along different angles of an axis of the hinge **130**. However, the hinge **130** may be slimmer and/or simpler in design, by having the friction component placed away from the hinge **130**.

FIG. 3A is an example diagram of a side-view of the case of FIG. 2 with respect to an open position. FIG. 3B is an example diagram of a side-view of the case **200** of FIG. 2 with respect to a closed position. As shown in FIG. 3A, the cable connection **210** extends between the heat emitting surface **112** and the heat dissipating member **126** and over the hinge **130**. While the cable connection **210** is shown to be substantially straight, embodiments are not limited thereto. For example, the cable connection **210** may also have a curved shape.

As shown in FIG. 3B, a gap between the heat diffusing surface **112** and the heat dissipating member **124** is substantially small when the display unit **120** is in the closed position. For example, the heat diffusing surface **124** and the heat dissipating member **112** may have complementary surfaces facing each other so as to have the substantially small gap or no gap therebetween. For example, the gap may be 1 millimeter (mm) or less.

Further, as shown by the transmitted heat line  $H_{tr}$ , heat may pass out of the heat dissipating member **112** and through the heat diffusing surface **124**, even when the display unit **120** is in the closed position. For example, an opening or air vent of the heat diffusing surface **112** may align with that of the heat dissipating member **124** so that heated air may flow freely out of the base unit **110**, when the display unit **120** is in a closed position.

Further, as shown in FIG. 3B, the cable connection **210** is not visible between the heat diffusing surface **112** and the heat dissipating member **124** when the display unit **120** is in a

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closed position. Instead, the cable connection **210** may, for example, retract into the base unit **110**.

FIG. 4A is an example diagram of a top-down view of the case **200** of FIG. 2 with respect to the open position. FIG. 4B is an example diagram of a top-down view of the case **200** of FIG. 2 with respect to the closed position. As shown in FIG. 4A, the heat emitting surface **112** and the heat dissipating member **124** may not overlap when display unit **120** is in the open position. However, as shown in FIG. 4B, the heat emitting surface **112** and the heat dissipating member **124** are to overlap when display unit is in a closed position.

FIG. 5 is an example flow chart for a method **500** of dissipating heat. Although execution of method **500** is described below with reference to the case **100**, other suitable components for execution of the method **500** can be utilized, such as the case **200**. At block **510**, a heat generating component inside the base unit **110** generates the heat. Then, at block **520**, the heat diffusing surface **112** or a first vent at a first side of a base unit **110** diffuses the heat. Lastly, at block **530**, the diffused heat passes through heat dissipating member **124** or a second vent of the display unit **120** connected to the first side via a hinge **130** below at least part of the first and second vents, when the display unit **120** is in a closed position.

According to the foregoing, embodiments provide a method and/or a dropped hinge for connecting a display unit to a first side a base unit while allowing for heat to pass freely from the first side of the base unit and through at least part of the display unit, regardless of whether the display unit is an open or closed position. In addition, embodiments may also include a retractable member above the hinge. Thus, the cables may not obstruct the heat from passing through at least part of the display unit while also providing a thinner profile and smoother rotation for the hinge.

What is claimed is:

1. A case, comprising:

a base unit including an emitting surface;

a display unit including,

a stand having a heat dissipating member, and

a lid connected to the stand, the lid being above the stand; and

a hinge to connect the base unit and the display unit, the hinge connected below at least part of the heat emitting surface and the heat dissipating member, wherein the heat emitting surface and the heat dissipating member are to overlap when display unit is in a closed position.

2. The case of claim 1, further comprising:

a cable connection between the display unit and the base unit, wherein

the cable connection is above the hinge.

3. The case of claim 2, wherein the cable connection includes a retractable member, the retractable member to move into the base unit when the display unit is rotated towards the base unit and to move out of the base unit when the display unit is rotated away from the base unit.

4. The case of claim 3, further comprising:

a friction component connected to the retractable member, the friction component to inhibit a movement of the retractable member to maintain a position of the display unit.

5. The case of claim 2, wherein the cable connection is between the heat emitting surface and the heat dissipating member.

6. The case of claim 1, wherein the heat dissipating member includes an opening to allow the heat to pass through the opening.

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- 7. The case of claim 1, wherein the hinge is connected below an entirety of the heat emitting surface and the heat dissipating member.
- 8. The case of claim 1, wherein an angle between the stand and the lid is acute with respect to the base unit.
- 9. The case of claim 1, wherein the heat diffusing surface is exposed when the display unit is an open position.
- 10. The case of claim 1, wherein a gap between the heat diffusing surface and the heat dissipating member is substantially small when the display unit is in the closed position.
- 11. The case of claim 1, wherein,
  - a thickness of at least part of the stand is less than the lid, and
  - the lid includes a display.
- 12. A case, comprising:
  - a base unit including,
    - a heat generating component to generate heat,
    - a vent at a first side of the base to dissipate the heat of the heat generating unit;
  - a display unit including,
    - a display, and

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- an opening to align with at least part of the vent if the display unit is in a closed position; and
  - a hinge to connect the display unit to the first side of the base.
- 13. The case of claim 12, wherein the hinge is connected below at least part of the vent and the opening.
- 14. The case of claim 12, further comprising:
  - a cable connection between the display unit and the base at the first side,
  - wherein the cable connection is above the hinge.
- 15. A method for dissipating heat from a case, comprising:
  - generating the heat at a heat generating component inside a base unit;
  - diffusing the heat from a first vent at a first side of the base unit; and
  - passing the diffused heat through a second vent of a display unit connected to the first side via a hinge below at least part of the first and second vents, if the display unit is in a closed position, wherein the first and second vents overlap when the display unit is in the closed position.

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